

**REMARKS**

This Response to the final Office Action dated February 22, 2008, is respectfully submitted to be fully responsive to the rejections raised therein. Accordingly, favorable reconsideration on the merits and allowance are respectfully requested.

Claims 1-14 are pending, claims 6-13 of which are withdrawn. The following lists the rejection of claims 1-5 and 14 as set forth in the final Office Action of February 22, 2008:

(1) Claim 14 is rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent 5,150,006 ("Van Slyke") in view of Shunk *et al* Journal of the American Chemical Society, v. 71, No. 12, December 1949 ("Shunk");

(2) Claims 1-5 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,791,258 ("Haase") in view of Van Slyke and further in view of Shunk;

(3) Claims 1-5 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,303,238 ("Thompson") in view of Van Slyke and further in view of Shunk and Baldo *et al*. Physical Review B, 2000 vol. 62(16) pp. 10958-10966 ("Baldo");

(4) Claims 1-5 are provisionally rejected on the grounds of non-statutory obviousness-type double patenting as assertedly being unpatentable over claims 3, 5, 11, 12 and 15 of co-pending Application No. 10/282,244, in view of Van Slyke; and

(5) Claims 1-5 are provisionally rejected under § 103(a) as being obvious over Application No. 10/282,244 in view of Van Slyke.

**I. Response to Rejections (1) - (3) and Provisional Rejection (5) Under 35 U.S.C. § 103(a)**

Applicants' respectfully traverse and request reconsideration and withdrawal of the

rejection in view of the following remarks.

First, Applicants respectfully submit and request consideration of a Rule 132 Declaration executed by Mr. Taishi Tsuji, attached hereto, to show an unexpectedly superior effect of the claimed electroluminescent (EL) device over the EL device disclosed in Van Slyke.

Next, Applicants submit a sworn English translation of priority document based on Japanese patent application No. P2000-96908, attached hereto, to overcome the provisional rejection under 35 U.S.C. § 103(a) based on U.S. 2003/0129452 (U.S. Application No. 10/282,244) in view of Van Slyke.

Third, Applicants respectfully submit that the organic EL device according to the presently claimed invention recited in claim 1 has features characterized in that the light emitting layer includes an organic host material represented by the following structural formula (1), i.e., bis(2-methyl-8-quinolinolato) (6-phenyl-2-naphtholato) aluminum (III), and a phosphorescent organic guest material.

In contrast, Van Slyke neither discloses or teaches a bis(2-methyl-8-quinolinolato) (6-phenyl-2-naphtholato) aluminum (III) nor a phenyl substituent on the naphtholato ligand of bis(8-quinolinolato) (naphtholato) aluminum compounds. Van Slyke discloses bis(2-methyl-8-quinolinolato)aluminum chelates in columns 12-13 and 14-15, such as:

PC-5 in lines 52-65 in column 12, bis(2-methyl-8-quinolinolato)(o-phenylphenolato)aluminum (III);

PC-6, line 66 of column 12 through line 10 column 13, bis(2-methyl-8-quinolinolato)(m-phenylphenolato)aluminum (III);

PC-7, lines 11-21 in column 13, bis ( 2-methyl-8 -quinolinolato ) (p-phenylphenolato) aluminum (III);

PC-17, line 66 of column 14 through line 10 column 15, bis(2-methyl-8-quinolinolato)(1-naphtholato ) aluminum (III); and

PC-18, lines 11-24 in column 15, bis ( 2 -methyl- 8-quinolinolato ) ( 2-naphtholato ) aluminum (III).

Van Slyke's PC-18 resembles the host material in the present invention, bis(2-methyl-8-quinolinolato) (6-phenyl-2-naphtholato) aluminum (III).

Van Slyke discloses bis(8-quinolinolato) aluminum chelate compounds in columns 10-17 and mainly teaches aluminum compounds having phenolato ligands rather than having naphtholato ligands.

Van Slyke states "from further investigations, illustrated by the Examples below, it has been determined that the preferred phenolato ligands for the aluminum chelates of formula II are derived from HO-L phenols, where L is a hydrocarbon of from 6 to 24 carbon atoms comprised of a phenyl moiety" and further that "investigations of phenolato ligands with 18 aromatic ring carbon atoms have revealed high levels of stability. Thus, the phenolato ligands preferably contain from 7 to 18 total carbon atoms". Concretely each of Van Slyke's PC-5, PC-6 and PC-7 has the phenylphenolato ligand which contain 12 carbon atoms. Each of Van Slyke's PC-17 and PC-18 has the naphtholato ligand containing 10 carbon atoms.

One of the inventors, Mr. Taishi Tsuji, has conducted an experimentation based on Van Slyke's teachings that "the phenolato ligands preferably contain from 7 to 18 total carbon atoms". The results of the experimentation particularly verified levels of luminance stability of

aluminum chelate compounds comprising the phenolato ligands containing 10, 13, 14 and 16 carbon atoms in the EL devices. (See, Tsuji's Declaration attached herewith).

The present inventors have made a discovery based on the characteristics in a specific bis(8-quinolinolato) aluminum chelate compound having a naphtholato ligand, i.e., bis(2-methyl-8-quinolinolato) (6-phenyl-2-naphtholato) aluminum (III).

Tsuji's Declaration under 37 C.F.R. § 1.132 demonstrates that the presently claimed invention produces unexpectedly superior results over the EL device using materials disclosed in Van Slyke. The Declaration contains data comparing the characteristics of the EL device of Example 1 described on pages 45-48 of the present specification with EL devices using the most similar Van Slyke's PC-18, and aluminum chelate compounds comprising the phenolato ligands induced from Van Slyke's PC-6 and PC-7.

The aluminum chelate derivatives induced from Van Slyke's PC-6 and PC-7 are:

PC-6 like (TS-328) (14 carbon atoms phenolato ligand) of bis(2-methyl-8-quinolinolato) (3',4'-dimethyl-m-phenylphenolato) aluminum (III);

PC-7 like (TS-320) (14 carbon atoms phenolato ligand) of bis(2-methyl-8-quinolinolato) (3', 4'-dimethyl-p-phenylphenolato) aluminum (III);

PC-7 like (TS-321) (16 carbon atoms phenolato ligand) of bis(2-methyl-8-quinolinolato) (1-naphthyl-p-phenylphenolato) aluminum (III); and

PC-7 like (TS-335) (13 carbon atoms phenolato ligand) of bis(2-methyl-8-quinolinolato) (3-methyl-4-phenylphenolato) aluminum (III).

As can be seen from the Tsuji's comparative experimentation results, the EL devices of Claim 1 (TS-343), TS-265 (PC-18), and TS-320 (PC-7 like) are better in the half-life of electroluminescence intensity than those of TS-321 (PC-7 like), TS-328 (PC-6 like), and TS-335

(PC-7 like), even though the PC-7 like device (TS-321) comprises of 4-( $\alpha$ -naphthyl)-phenolato ligand with 16 carbon atoms and has a short half-life. There are little correlations between the EL stability and the phenolato ligands containing from 10 to 16 aromatic ring carbon atoms.

Furthermore, as apparent from the 100°C storage test of Tsuji's comparative experimentation, the EL devices of Claim 1 (TS-343) is more excellent in durability than TS-265 (PC-18), and TS-320 (PC-7 like).

Applicants therefore respectfully submit that the claimed EL device has an unexpectedly superior luminance and half-life durability when compared to the EL devices using the similar bis ( 2 -methyl- 8 -quinolinolato ) aluminum chelates disclosed in Van Slyke.

With respect to the rejection based on Haase, in view of Van Slyke and Shunk, Applicants submit that the difference between the subject matter in claim 1 and the subject matter in Haase is that Haase teaches that the hole transport layer may comprise BAlq and optionally, a second electron transporting layer may be deposited over a doped transport layer. Haase teaches that Alq3 can be used in the optional second layer. On the contrary, present claim 1 recites that the light emitting layer comprises an organic material having an electron transportability doped with an organic host material of formula (1), which is structurally different from BAlq and Alq3.

Further, as disclosed in Applicants' disclosure, BAlq is excellent in durability, but it has its drawback of having poor hole blocking ability since IP is not sufficiently high. Thus, the specific aluminum chelate of formula (1) achieves unexpectedly superior results (i.e., high luminance efficiency) compared to BAlq and bis(2,4-dimethyl-8-quinolinolato)(ortho-phenylphenolato)aluminum (III).

In view of the compositional differences and unexpectedly superior results, Applicants submit that the presently claimed invention is unobvious over Van Slyke, alone or in view of

Shunk, Haase, Thompson and Baldo. Accordingly, withdrawal of the Section 103(a) rejections is requested.

The Examiner's position is that Shunk serves to provide evidence that a chemical precursor is known in to one skilled in the art based on teachings of chemical literature. Van Slyke does not teach any phenyl substituent on the naphtholato ligand of bis (8-quinolinolato) (naphtholato) aluminum compounds. Thus, it would be difficult for one skilled in the art to combine a specific one of Shunk's precursors with Van Slyke's aluminum chelate compounds. One skilled in the art does not know the chemical roles or functions of Shunk's chemical precursors at that time of the present invention. The inventors disclose the chemical roles or functions of bis (2-methyl-8-quinolinolato) (6-phenyl-2-naphtholato) aluminum (III). The aluminum chelate molecule claimed in claim 1 is non-obvious over Van Slyke even in the view of Shunk, which is a non-analogous art. Consequently the Applicants respectfully requests withdrawal of Shunk and Van Slyke.

Next, the Examiner's position is that Thompson discloses an EL device with a light-emitting layer comprising Alga and platinum octaethylporphine (PtOEP). However, Thompson fails to disclose any BAIq. Thus, the devices disclosed by Thompson are different from the device of the claims mentioned above. Accordingly, withdrawal of the Thompson reference is respectfully requested.

Baldo teaches that the energy difference between triplet energies of host material and guest material is determined by Gibb's free energy change  $\Delta G$ . (See the third paragraph of the right column on page 10961 and Fig. 1). It is noted that the most important physical parameter is triplet state level for the host material of the light emitting layer in the organic EL device using the phosphorescence. When energy transfers from a host material to a guest material in the

condition that triplet energy of host material is higher than triplet energy of guest material, then the free energy change  $\Delta G$  is negative ( $\Delta G < 0$ ). Baldo teaches that “guest-host combinations with  $\Delta G < 0$  generally exhibit superior performance by minimizing losses at the host.” (See the second paragraph from the bottom of the right column on page 10965). Baldo discloses that material triplet energies at Table I of the right column on page 10962, in which, Alq3’s triplet energy about 2.0eV is shown. Applicants respectfully direct the Examiner’s attention to the Alq3 triplet energy which is inferred from the phosphorescent spectra related hydroxyquinoline complex of Pb, Bi, Rb and Ir. At the time of Baldo, it was known that the aluminum chelate did not exhibit any phosphorescence, even at an extremely low temperature. Furthermore, in those days, there was no data showing triplet state levels as a fixed quantity of the Alq3.

Nevertheless, Baldo does not disclose BALq. There is therefore no data that triplet energy of BALq is greater than that of Alq3. Furthermore, Van Slyke and Shunk are also silent as to triplet energy. Accordingly, there is no motivation to combine Baldo with Van Slyke and Shunk. Thus, Applicants respectfully requests withdrawal of the rejections based on Thompson, in view of Van Slyke, Shunk and Baldo.

The Examiner is requested to consider the excellent EL durability of the EL device presently claimed in Claim 1 (TS-343). This is the basis of the inventors’ efforts of many experiments using numerous organic host materials. For the above-mentioned reasons, an artisan skilled in the art could not arrive at the presently claimed invention based on the teachings of the prior art with the expectation of success.

Furthermore, claims 2-5 depend from claim 1 either directly or indirectly and are therefore patentable over the references for at least the reasons given with respect to the

patentability of claim 1. Thus, Applicants request withdrawal of the rejection of claims 1-5 and 14 in view of the remarks and in further view of the Declaration of Mr. Tsuji.

**II. Response to Provisional Double Patenting Rejection (4)**

Claims 1-5 are provisionally rejected on the grounds of non-statutory obviousness-type double patenting as assertedly being unpatentable over claims 3, 5, 11, 12 and 15 of co-pending Application No. 10/282,244, in view of Van Slyke.

Applicants respectfully request that the rejection be held in abeyance until allowable subject matter has been indicated in one of the applications.

**III. Conclusion**

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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CUSTOMER NUMBER

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